SERENDIPITY IN THE PRIMARY GRADES

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The National Council of Teachers of Mathematics in its Curriculum Standards for Grades K-4 states that the need for curricular reform in K-4 mathematics is clear. Such reform must address both the content and emphasis of the curriculum as well as approaches to instruction. A long-standing preoccupation with computation and other traditional skills has dominated both what mathematics is taught and the way mathematics is taught at this level. As a result, the present K-4 curriculum is narrow in scope; fails to foster mathematical insight, reasoning, and problem solving; and emphasizes rote activities. Even more significant is that children begin to lose their belief that learning mathematics is a sense-making experience. They become passive receivers of rules and procedures rather than active participants in creating knowledge.[1] The Standards emphasize involving children in doing mathematics in grades K-4 by interacting with materials and other children. The National Research Council reports that the teaching of mathematics is shifting from an authoritarian model based on "transmission of knowledge" to a student-centered practice featuring "stimulation of learning."[2] Teachers need to explore, develop, test, discuss and apply ideas.[3]

William J. Bennett, as Secretary of Education, stated that, "what our children need are lessons that explore unfamiliar possibilities, and that play on their imaginative capacities." Referring to mathematics Bennett stated that, "American students are doing poorly because mathematics is too often taught as isolated formal skills rather than a means of solving real problems."[4]

Teachers' Roles

Teachers must prepare their students to be challenged by situations they and their students have not met previously. Students will be unsure about how to start the solution to a problem and unaware of how much time and effort it will take for a reasonable solution. Attitudes of the teacher and students will be important. Students must have confidence that their problem-solving strategies are adequate to solve the problems presented to them.

Teachers should search for and examine good problem situations to determine if the problems are appropriate for their students. With young children, working and playing are synonymous. Free play happens naturally. Children learn many mathematics concepts while playing with blocks, puzzles, games, the

housekeeping center, cooking corner and the woodworking bench. Many of these pleasant, worthwhile activities lend themselves to problem-solving – weighing, measuring, seeing spatial relationships and determining quantity.

Teaching problem solving requires a teacher to help students become willing to solve problems. Problem-solving strategies must be taught so students can solve problems. Teachers must teach students to think their way through problems to reasonable solutions. The skills taught should include listening and reading skills, skills related to following directions, and the skills that relate to the use of numbers, relations, and operations.

Strategies

Strategies are techniques for finding answers or explanations for questions or situations that present uncertainity or difficulty. There is no specific strategy to enhance successful problem solving. The only criterion is that the problem be solved in an efficient manner for the problem solver.

Suggested Problem Situations for the Primary Grades

Teachers of young children need to be able to rise to the occasion of a spontaneous experience such as the "teachable moment" of a special show and share time.

Show and Share

Upon returning from a Spring vacation in Florida, a child who had enjoyed exploring the ocean beach brought to class a collection of beautiful shells. After discussion, show and tell, and sharing, the teacher led the group to more discovery involving:

1. classification
   - kind of shells, recognizing same and different kinds
2. shape
   - comparing various shapes
3. size
   - measuring; weighing; using terms of more, less, bigger, smaller
4. looking for patterns; grouping
5. counting

Displays using the skills were set up according to problem-solving activities. Learning and discovery games with shells were created using the skills. One special activity was a "Lotto" game created by using the shells. Six lotto cards were made

on pieces of cardboard. Outlines of six shells were made on each card. The real shells were placed in the middle of the table. Four to six children sat around the table. Each child reached out and "drew" a shell, held it up and placed it on the card where it matched. This sequence went on until all cards were filled. The teacher guided the discussion and directed the activity.

Cooking Experience

The everyday experiences in preschools and kindergartens provide numerous problem-solving activities involving the preparation of nutritious snacks. Each day a new plan is presented which follows a format such as:

1. Introduction and discussion of the snack for the day.
   Example: "Bugs on a Log"
2. Recipe on a large chart is presented:
   1 large celery stalk
   8 raisins
   1 teaspoon peanut butter
3. Children proceed to prepare the snacks for eating:
   Remove green leaves on celery. Wash celery stalk.
   Spread peanut butter on celery. Place raisins along stalk.

Another example is the Honey Balls recipe:

Combine: 1/2 cup powdered milk
1/2 cup honey
1/3 cup peanut butter

Put in bowl and stir. Chill. Roll into balls.

Through these activities, children learn to identify numbers, count, measure, and classify objects and act out the solution to the problem of equal food distribution. They can act out and see the difference between 1/3 cup and 1/2 cup. The recipe charts are important for the child to see the pictures and "read" the directions and ingredients.

Shapes and Sizes

Geometric shapes are explored through the use of crackers with the various shapes of circles, squares, rectangles, and triangles. Children can also find these shapes around the room – in table-top games, toys, furniture, and other objects within their environment.

Building blocks of all shapes and sizes fit right into the scheme of discovering geometric forms. A good supply of blocks includes a variety of shapes and sizes.

Through all of these activities, the teacher assists in the learning experience by guiding discussions and introducing problems. These activities provide readiness for the use of attribute blocks in the primary grades and allows the children to discuss and act out the solutions to problems presented by the teacher.

Estimation

Kindergarten children should be asked to estimate answers regarding real life situations. Children should record their estimates on a sheet of paper and then discuss the estimates with their teachers. Types of questions that could be asked are:

1. How many people in this room are left-handed?
2. How many people in this class have a dog?
3. How many people in this room are wearing glasses?
4. How many people in this room have a birthday in November?

It is important that all children estimate an answer. Interesting questions may arise relating to whether contact lenses are glasses and to whether the teacher is a person in the room. These provide the teacher with ample opportunities for problem-solving questions to relate children's responses to real world situations.

Summary

Children live in a world of mathematics. A good environment for using mathematics in kindergarten and the early primary grades is essential so students have the opportunities to discover and solve problems. Do not underestimate the ability of primary grade students to solve problems. Often students will use strategies that teachers are unable to predict. Students in the primary grades are able to make estimates, keep records of their observations, account for all possibilities, and make decisions on the basis of what has or may happen in a given situation. Students must be taught to believe they can solve a problem and must also be confident when they arrive at a reasonable answer. Problems in the primary grades must be difficult enough to present some challenge, but easy enough so that solving them instills confidence. A student's tolerance time for dealing with a problem before giving up will be gradually increased as the student understands more strategies for solving problems.

Problem solving in the primary grades should not be dependent upon reading ability. Students should have problems read to them before and after they have learned to read. Students in the primary grades need to begin to develop a variety of strategies for solving problems and these strategies need to be identified and

discussed with the students as helpful actions to use in solving problems. The "teachable moments" can come through a variety of ways such as:

1. a spontaneous occurrence – something not even in the lesson plan book – such as a weather phenomenon like a sudden rainbow or tornado, or a child bringing into class something for show and share.
2. a teacher-planned event which leads up to discovery and new understanding.
3. introducing or culminating a unit.

Take advantage of the serendipity experiences in teaching and look for those magic "teachable moments".

[1]NCTM. *Curriculum and Evaluation Standards for School Mathematics.* Reston, VA: The National Council of Teachers of Mathematics, Inc.; March 1989; p. 15.

[2]Hill, S.A., Griffiths, P.A., & Bucy, J.F. *Everybody Counts – A Report to the Nation on the Future of Mathematics Education.* Washington, D.C.: National Academy Press, 1989; p. 81.

[3]NCTM. *Curriculum and Evaluation Standards for School Mathematics*, p. 17.

[4]Bennett, William J. "Elementary School Curriculum Reform Urged By Bennett". *Toledo Blade*; September 3, 1986; p. 1.